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Assessment of listing and categorisation of animal diseases within the framework of the Animal Health Law (Regulation (EU) No 2016/429): equine encephalomyelitis (Eastern and Western)

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Abstract

Equine encephalomyelitis (Eastern and Western) has been assessed according to the criteria of the Animal Health Law (AHL), in particular criteria of Article 7 on disease profile and impacts, Article 5 on the eligibility of equine encephalomyelitis (Eastern and Western) to be listed, Article 9 for the categorisation of equine encephalomyelitis (Eastern and Western) according to disease prevention and control rules as in Annex IV, and Article 8 on the list of animal species related to equine encephalomyelitis (Eastern and Western). The assessment has been performed following a methodology composed of information collection and compilation, expert judgement on each criterion at individual and, if no consensus was reached before, also at collective level. The output is composed of the categorical answer, and for the questions where no consensus was reached, the different supporting views are reported. Details on the methodology used for this assessment are explained in a separate opinion. According to the assessment performed, equine encephalomyelitis (Eastern and Western) can be considered eligible to be listed for Union intervention as laid down in Article 5(3) of the AHL. The disease would comply with the criteria as in Section 5 of Annex IV of the AHL, for the application of the disease prevention and control rules referred to in point (e) of Article 9(1). The assessment here performed on compliance with the criteria as in Section 4 of Annex IV referred to in point (d) of Article 9 (1) is inconclusive. The animal species to be listed for equine encephalomyelitis (Eastern and Western) according to Article 8(3) criteria are several species of mammals, birds, reptiles and amphibians as susceptible species; rodents, lagomorphs and several bird species as reservoirs and at least four mosquito species (family Culicidae) as vectors.

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Table of contents

Abstract.....	1
1. Introduction.....	4
1.1. Background and Terms of Reference as provided by the requestor.....	4
1.2. Interpretation of the Terms of Reference.....	4
2. Data and methodologies.....	4
3. Assessment.....	4
3.1. Assessment according to Article 7 criteria.....	4
3.1.1. Article 7(a) Disease Profile.....	4
3.1.1.1. Article 7(a)(i) Animal species concerned by the disease.....	4
3.1.1.2. Article 7(a)(ii) The morbidity and mortality rates of the disease in animal populations.....	5
3.1.1.3. Article 7(a)(iii) The zoonotic character of the disease.....	6
3.1.1.4. Article 7(a)(iv) The resistance to treatments, including antimicrobial resistance.....	6
3.1.1.5. Article 7(a)(v) The persistence of the disease in an animal population or the environment.....	6
3.1.1.6. Article 7(a)(vi) The routes and speed of transmission of the disease between animals, and, when relevant, between animals and humans.....	7
3.1.1.7. Article 7(a)(vii) The absence or presence and distribution of the disease in the Union, and, where the disease is not present in the Union, the risk of its introduction into the Union.....	8
3.1.1.8. Scarce data are available about carrier status (see Section 3.1.1.5).....	9
3.1.1.9. Article 7(a)(viii) The existence of diagnostic and disease control tools.....	9
3.1.2. Article 7(b) The impact of diseases.....	10
3.1.2.1. Article 7(b)(i) The impact of the disease on agricultural and aquaculture production and other parts of the economy.....	10
3.1.2.2. Article 7(b)(ii) The impact of the disease on human health.....	11
3.1.2.3. Article 7(b)(iii) The impact of the disease on animal welfare.....	11
3.1.2.4. Article 7(b)(iv) The impact of the disease on biodiversity and the environment.....	11
3.1.3. Article 7(c) Its potential to generate a crisis situation and its potential use in bioterrorism.....	11
3.1.4. Article 7(d) The feasibility, availability and effectiveness of the following disease prevention and control measures.....	12
3.1.4.1. Article 7(d)(i) Diagnostic tools and capacities.....	12
3.1.4.2. Article 7(d)(ii) Vaccination.....	12
3.1.4.3. Article 7(d)(iii) Medical treatments.....	12
3.1.4.4. Article 7(d)(iv) Biosecurity measures.....	12
3.1.4.5. Article 7(d)(v) Restrictions on the movement of animals and products.....	12
3.1.4.6. Article 7(d)(vi) Killing of animals.....	13
3.1.4.7. Article 7(d)(vii) Disposal of carcasses and other relevant animal by-products.....	13
3.1.5. Article 7(e) The impact of disease prevention and control measures.....	13
3.1.5.1. Article 7(e)(i) The direct and indirect costs for the affected sectors and the economy as a whole.....	13
3.1.5.2. Article 7(e)(ii) The societal acceptance of disease prevention and control measures.....	13
3.1.5.3. Article 7(e)(iii) The welfare of affected subpopulations of kept and wild animals.....	13
3.1.5.4. Article 7(e)(iv) The environment and biodiversity.....	13
3.2. Assessment according to Article 5 criteria.....	13
3.2.1. Non-consensus questions.....	14
3.2.2. Outcome of the assessment of equine encephalomyelitis (Eastern and Western) according to criteria of Article 5(3) of the AHL on its eligibility to be listed.....	15
3.3. Assessment according to Article 9 criteria.....	15
3.3.1. Non-consensus questions.....	17
3.3.2. Outcome of the assessment of criteria in Annex IV for equine encephalomyelitis (Eastern and Western) disease for the purpose of categorisation as in Article 9 of the AHL.....	19
3.4. Assessment of Article 8.....	21
4. Conclusions.....	22
References.....	22
Abbreviations.....	25

1. Introduction

1.1. Background and Terms of Reference as provided by the requestor

The background and Terms of Reference (ToR) as provided by the European Commission for the present document are reported in Section 1.2 of the scientific opinion on the ad hoc methodology followed for the assessment of the disease to be listed and categorised according to the criteria of Article 5, Annex IV according to Article 9, and 8 within the Animal Health Law (AHL) framework (EFSA AHAW Panel, 2017a).

1.2. Interpretation of the Terms of Reference

The interpretation of the ToR is as in Section 1.2 of the scientific opinion on the ad hoc methodology followed for the assessment of the disease to be listed and categorised according to the criteria of Article 5, Annex IV according to Article 9, and 8 within the AHL framework (EFSA AHAW Panel, 2017a).

The present document reports the results of assessment on equine encephalomyelitis (Eastern and Western) according to the criteria of the AHL articles as follows:

- Article 7: equine encephalomyelitis (Eastern and Western) profile and impacts
- Article 5: eligibility of equine encephalomyelitis (Eastern and Western) to be listed
- Article 9: categorisation of equine encephalomyelitis (Eastern and Western) according to disease prevention and control rules as in Annex IV
- Article 8: list of animal species related to Equine encephalomyelitis (Eastern and Western)

2. Data and methodologies

The methodology applied in this opinion is described in detail in a dedicated document about the ad hoc method developed for assessing any animal disease for the listing and categorisation of diseases within the AHL framework (EFSA AHAW Panel, 2017a).

3. Assessment

3.1. Assessment according to Article 7 criteria

This section presents the assessment of equine encephalomyelitis (Eastern and Western) according to the Article 7 criteria of the AHL and related parameters [see table 2 of the opinion on methodology (EFSA AHAW Panel, 2017a)], based on the information contained in the fact-sheet as drafted by the selected disease scientist (see Section 2.1 of the scientific opinion on the ad hoc methodology) and amended by the AHAW Panel.

3.1.1. Article 7(a) Disease Profile

Eastern Equine Encephalitis (EEE) and Western Equine Encephalitis (WEE) are caused by infection with EEE virus (EEEV) or WEE virus (WEEV), respectively. Both of them are Alphavirus in the Togaviridae family. EEEV is composed by several lineages distributed in North America (lineage I) or South America [lineages II, III and IV, named recently as Madariaga virus (MADV)].

EEEV is maintained in North America between passerine birds and *Culiseta melanura* mosquitoes and wild birds. In South America, the cycle is not well established but it seems that *Culex (Melanoconion)* mosquitoes and rodents/marsupials play an important role.

WEEV is maintained by *Culex tarsalis* and passerine birds although domestic and wild birds and lagomorphs and rodents and *Aedes* mosquitoes could also be involved.

Both viruses have a single-stranded, positive-sense RNA genome and the particles are enveloped, spherical and have a diameter of 60–65 nm.

3.1.1.1. Article 7(a)(i) Animal species concerned by the disease

EEEV can infect horses (causing severe disease) (Carrera et al., 2013). Other species such as white-tailed deer (*Odocoileus virginianus*) (Tate et al., 2005; Schmitt et al., 2007), cattle, sheep and dogs (McGee et al., 1992; Acha and Szyfres, 2003; Pfeiffer and Dobler, 2010; Zacks and Paessler, 2010; OIE, 2013; Hubalek et al., 2014; Arechiga-Ceballos and Aguilar-Setien, 2015) or African penguins (*Spheniscus*

demersus) (Tuttle et al., 2005) are susceptible to infection. However, the virus can also infect reptiles, amphibians and rodents (Bingham et al., 2012; Graham et al., 2012).

It seems that two different reservoirs are involved in the cycle of EEEV: passerine birds in North America and some rodents and/or marsupials in South America (Mesa et al., 2005; Go et al., 2014).

Mature cotton rats (from the genus *Sigmodon*) experimentally infected with Madariaga strains developed symptoms, while infection with North American (NA) strains of EEEV resulted in death (Arrigo et al., 2010). This difference was also seen with common marmosets, since when infected by MADV, viraemia was observed during 2 or 4 days after infection and the virus was not detected in any tissue at the time of sacrifice or death. When infected by NA strains they developed no viraemia and the virus was detected mainly in brain but also in liver and muscle at 4–5 days after infection (Adams et al., 2008).

Several amphibians and mammals were experimentally infected by EEEV and most of them were refractory to the virus (Hayes et al., 1964). Experimental infection has been carried out also with house sparrows (*Passer domesticus*) (Arrigo et al., 2010), mice (Gardner et al., 2009), turkeys (Guy et al., 1993), emus (genus *Dromaius*) (Tengelsen et al., 2001), horses, calf, crows (genus *Corvus*), great-horned owls (*Bubo virginianus*) and pheasants (subfamily Phasianinae) (Satriano et al., 1958), green anole (*Anolis carolinensis*) and garter snake (*Thamnophis sirtalis*) (White et al., 2011), pigs and burros (Sudia et al., 1956; Byrne et al., 1964; Walton et al., 1989; Elvinger et al., 1996).

Passerine birds, ground squirrel (*Citellus richardsoni*), black-tailed jackrabbit (*Lepus californicus californicus*) and probably snakes and frogs are infected by WEEV which also causes illness in horses and humans (Hardy et al., 1977; Acha and Szyfres, 2003; Hubalek et al., 2014) although both species are considered as dead-end hosts (Acha and Szyfres, 2003; Mesa et al., 2005; OIE, 2013). While the natural reservoir in North America are different species of birds it seems in South America, rodents such as rice rats (*Oryzomys* spp.), rabbits and *Lepus europaeus* (Monath et al., 1985; Acha and Szyfres, 2003; Pfeffer and Dobler, 2010; Zacks and Paessler, 2010; OIE, 2013; Hubalek et al., 2014; Arechiga-Ceballos and Aguilar-Setien, 2015) play this role.

Rabbits (Gresikova and Zavada, 1966), ponies (Sponseller et al., 1966) and blacktail jackrabbits (Hardy et al., 1977) have been experimentally infected by WEEV.

3.1.1.2. Article 7(a)(ii) The morbidity and mortality rates of the disease in animal populations

Outbreaks of EEE in horses in North America are common and often accompanied by high case fatality rates: 80–90% of the infected horses develop acute and lethal disease, and about 66% of the survivors develop neurological sequelae (Scott and Weaver, 1989) as seen in Texas and Louisiana in 1947 when an estimated 14,334 horses and mules were infected and 11,727 died (Scott and Weaver, 1989). In South America before year 2000, few epizootics of MADV were recorded, but in 2008 and 2009 larger outbreaks occurred. In Brazil, 229 horses were affected with a case fatality rate of 73% and disease severity similar to that of North America (Long, 2015).

Clinical signs for horses infected by EEEV or WEEV are similar causing a disease named 'sleeping sickness' although the mortality is lower for WEEV which generally causes a mild disease after a short incubation period (5–15 days) with fever, malaise, headache, nausea, vomiting and anorexia. In some cases, symptoms of altered mental status, weakness and signs of meningeal irritation occurs and a minority of infected individuals develop encephalitis or encephalomyelitis.

The case fatality rate associated to WEEV in horses is about 20–30% (Acha and Szyfres, 2003; CFSPH, 2015). Associated mortality by EEEV infection in pheasants or emus could be as high as 75–87% (Scott and Weaver, 1989; Acha and Szyfres, 2003; Hubalek et al., 2014; CFSPH, 2015).

A decline to fewer than 10 cases per year in the annual number of cases due to WEEV has been observed in the USA since 1988 and no human or animal cases have been reported since 2003 (Zacks and Paessler, 2010), with no reported cases to the Centers for Disease Control and Prevention (CDC) in the period 2003–2016 (CDC/USGS, online-a). By reviewing available epidemiological data, Zacks and Paessler have estimated the average number of sick horses per year in 0–5 for WEEV and 120 for EEEV (Zacks and Paessler, 2010).

No clear data about prevalence or case-morbidity rate are available for these viruses.

3.1.1.3. Article 7(a)(iii) The zoonotic character of the disease

Presence

Parameter 1 – Report of zoonotic human cases (anywhere)

EEEV and WEEV are zoonoses and outbreaks in equids usually preceded, by one or several weeks, the emergence of human cases. In 1938, in Massachusetts, 34 cases with 25 deaths were reported, and in 1959 in New Jersey, 32 cases occurred (CDC, 2012, 2013, online-c). Furthermore, CDC reported that 220 confirmed human cases of EEE occurred in the U.S. between the years 1964 and 2004 (CDC, 2012, 2013, online-c). Of the 15 EEE cases in children reported in New Hampshire and Massachusetts between 1970 and 2010, seven were associated with mental disability, with only four of those cases improving (Silverman et al., 2013). A recent outbreak in Panama of EEE/Venezuelan equine encephalitis (VEE) in 2010 recorded 99 acute infection cases, where eight patients 1–13 years of age experienced neurological sequelae. The most common sequelae were seizures, which initially occurred in 63% of patients (Carrera et al., 2013).

In recent years, it seems that human cases of EEE are more frequent and have extended northward in New England (Armstrong and Andreadis, 2013; Oliver et al., 2016; CDC/USGS, online-b). Human cases in USA reported from 2004 to 2013 are summarised in Table 1 (CDC, online-d).

Table 1: Human cases in USA reported from 2004 to 2013

Year	Neuroinvasive disease		Non-neuroinvasive disease		Total	
	Cases	Deaths	Cases	Deaths	Cases	Deaths
2004	6	2	1	0	7	2
2005	21	8	0	0	21	8
2006	8	5	0	0	8	5
2007	3	0	1	0	4	0
2008	4	1	0	0	4	1
2009	3	1	1	0	4	1
2010	10	5	0	0	10	5
2011	4	3	0	0	4	3
2012	15	5	0	0	15	5
2013	8	4	0	0	8	4
total	82	34	3	0	85	34

Between 1964 and 2010, 640 cases of WEE were reported in the United States by the CDC (online-c) and it was concluded that children older than 14 years of age have a higher chance of acquiring WEEV infection. Cases have dwindled over the past few years for as yet undetermined reasons, but a drop in viral virulence is not considered to underlie this trend (Forrester et al., 2008). No human cases have been reported in USA since 2003 (CDC/USGS, online-a). Although the mortality rate for WEE is low, upwards of 30% of infections develop neurological sequelae. Between 1939 and 1956, there were 636 recorded cases of WEE in the United States and Canada, of which 86 cases had sequelae. The frequency of these sequelae in children under one year of age was greater than 50 (Herzon et al., 1957).

3.1.1.4. Article 7(a)(iv) The resistance to treatments, including antimicrobial resistance

Parameter 1 – Resistant strain to any treatment even at laboratory level

No specific treatment for EEE or WEE is available.

3.1.1.5. Article 7(a)(v) The persistence of the disease in an animal population or the environment

Animals are infectious during the viraemic period for a period that in most cases has been determined in some species through experimental infections that are summarised in the table below (Table 2). No data about the duration of the latent period is available.

Table 2: Summary of the viraemic period determined in some species through experimental infections

	Species	Titre of viraemia (pfu/ml)	Peak of viraemia	Duration of viraemia	Reference
EEEV	Cotton rats (juvenile)	10^{7-8}	48 h	4–5 days	Arrigo et al. (2010)
	Cotton rats (mature)	10^{4-5}	48 h	3–4 days	Arrigo et al. (2010)
	House sparrows	$10^{5-7.5}$	24 h	3–4 days	Arrigo et al. (2010)
	Mice	10^7 or 10^9			Gardner et al. (2009)
	Turkeys	10^6	24 h	2 days	Guy et al. (1993)
	Common marmosets (SA strains)	10^{2-3}	24–48 h	> 7 days	Adams et al. (2008)
	Common marmosets (NA strains)	No			Adams et al. (2008)
	Green anole and garter snake	10^{2-5}	7 days		White et al. (2011)
	Calf	No			Satriano et al. (1958)
	Horse	Yes		48 h	Satriano et al. (1958)
	Crow, great-horned owl and pheasant	Yes		24–120 h	Satriano et al. (1958)
	Amphibians and mammals	No			Hayes et al. (1964)
	Birds			1–4 days	Hayes et al. (1964)
	Reptiles			2–3 weeks	Hayes et al. (1964)
	Ponies	Low			Sponseller et al. (1966)
	Donkeys	About 10^3		1–2 days	Byrne et al. (1964) and Monath et al. (1985)
WEEV	Blacktail jackrabbits	$10^{6.4}$		3 days	Hardy et al. (1977)
	Donkeys	Low			Byrne et al. (1964) and Monath et al. (1985)

EEEV was isolated from 67 out of 1551 equids studied including healthy individuals in the USA during 1971 (Maness and Calisher, 1981). No other studies about the presence of the viruses in healthy carriers are available.

Studies about transovarial transmission of EEEV in mosquitoes are conflicting and it seems this is not an important overwintering mechanism for this virus (Scott and Weaver, 1989). However, WEEV has been isolated from larvae of *Aedes dorsalis* mosquitoes (Fulhorst et al., 1994).

Although the common rule is that togaviruses can be inactivated by 15 min of heat at 56°C, Park et al. (2016) have demonstrated that parameters such as temperature and time should be assayed individually to establish the parameters needed for complete heat-inactivation in alphaviruses. In fact, WEEV requires around 90 min to be completely inactivated at 56°C (Andrews and Turell, 2016). Like other enveloped viruses, togaviruses are susceptible to disinfectants such as 1% sodium hypochlorite, 4% formaldehyde, 2% glutaraldehyde, 70% ethanol and 3–6% hydrogen peroxide. Alphavirus virions are stable at pH 7–8. They are susceptible to radiant sunlight, moist or dry heat and drying, thus cool, moist, dark conditions favours survival (OIE, 2013) but taking these data into consideration, persistence of these viruses in environmental samples is negligible.

3.1.1.6. Article 7(a)(vi) The routes and speed of transmission of the disease between animals, and, when relevant, between animals and humans

EEEV and WEEV are arboviruses whose transmission to human or animals is mediated by the bite of an infected mosquito. No food-borne transmission has been described and only transmission from bird to bird has been reported as described below. Data about the transmission rate or incidence between animals and/or human are not available.

Culiseta melanura mosquitoes are the main vector for EEEV in North America although *Culex* spp. (*Culex peccator* and *Culex erraticus*) and *Uranotaenia sapphirina* play a role in the maintenance of enzootic cycles and some *Aedes* and *Coquillettidia* may act as bridge vectors. *Culex* (*Melanoconion*)

are responsible for the transmission of MADV. Studies about transovarial transmission of EEEV in mosquitoes are conflicting and it seems it is not an important overwintering mechanism for this virus (Scott and Weaver, 1989). The virus has been also shown to be transmitted from captive bird to bird orally mainly by pecking, feather picking or preening although cannibalism could also play a role (Acha and Szyfres, 2003; Mesa et al., 2005; Estep et al., 2011). No other contact transmission experiments or transplacental infection by EEEV have been reported.

WEEV is mainly transmitted by *Culex tarsalis* although *A. dorsalis*, *Aedes campestris* and *Ochlerotatus melanion* mosquitoes also play a role as bridge vectors (Acha and Szyfres, 2003; PHAC, online). WEEV has been isolated from larvae of *A. dorsalis* mosquitoes (Fulhorst et al., 1994). No contact transmission experiments or transplacental infection by WEEV have been reported. Mosquito species in which WEEV was detected and occurring in the European Union (EU) are *A. dorsalis* and *Aedes vexans*: <https://efsa.maps.arcgis.com/apps/MapJournal/index.html?appid=4f9f86684e3e465db01ddf9cc557bac9> (EFSA AHAW Panel, 2017b,c).

3.1.1.7. Article 7(a)(vii) The absence or presence and distribution of the disease in the Union, and, where the disease is not present in the Union, the risk of its introduction into the Union

Sporadic cases of infection by EEEV or WEEV occur in endemic regions although both viruses could cause outbreaks or epidemics when susceptible animals or humans and infected mosquitoes coincide. As for other arboviruses exotic in EU, the occurrence of sporadic cases, outbreaks or epidemics depends on the control activities carried out if the virus goes into the territory.

EEEV and WEEV are not present in the EU. EEEV is widely distributed throughout North (eastern part of USA and Canada), Central (Mexico, Cuba, Jamaica, the Dominican Republic) and South America (Guyana, Colombia, Peru, Brazil, Argentina). WEEV is distributed along North (western part including Canada and Mexico) and South America (Guyana, Brazil, Uruguay, Argentina). No clinical cases and no imported cases have been ever reported in the EU.

The risk for entry of EEEV is through infected mosquitoes, infected birds or infected rodents and amphibians and for WEEV also through infected mosquitoes or viraemic birds or rodents (Pfeffer and Dobler, 2010).

Durand and colleagues (Durand et al., 2013) established that between 2005 and 2009 diverse animals considered as potential hosts for EEEV or WEEV entered Europe. In Table 3, the numbers of animal imports and the consignments (in brackets) of potential reservoir animals for these viruses are shown (1 indicates risk for WEEV and 2 for EEEV).

Table 3: Number of animal imports and the consignments in Europe (Extracted from Durand et al. (2013), data from TRACES)

Species	Origin of the animals	
	North America	South America
Horses		15,703 (2,025) ¹
Poultry	15,5 M (518) ^{1,2}	61,945 (7) ^{1,2}
Other birds	391,348 (169) ^{1,2}	49,209 (160) ^{1,2}
Reptiles	5,881,321 (2,580) ¹	427,529 (605) ¹
Rodents	215,780 (5,879) ¹	448 (11) ¹

1: Consignments considered for EEEV emergence risk.

2: Consignments considered for WEEV emergence risk.

The risk estimated for the entry of WEEV or EEEV in Europe estimated by Pfeffer and Dobler (2010) is low, but due to the presence of passerine birds and small mammals and the relation of the viruses with *Culex pipiens* and *A. vexans* autochthonous transmission could be established although the risk for public or veterinary health are low. In another study, Durand et al. (2013) established the risk of entry to Europe for EEEV and WEEV. The risk for WEEV is three times lower than for EEEV and the consequences for health are also lower. For EEEV, the risk was attributed to exotic infected pets while for WEEV was due to poultry. The Netherlands, the north of Italy and West France are the areas with the highest risks for the entry of both viruses although Belgium and the South of England showed a high risk for EEEV entry too.

The AHAW Panel assessed overall rate of introduction of EEEV as low and WEEV as very low in the EU (EFSA AHAW Panel, 2017b), being the combination of the rate of entry of the pathogen, the level of transmission and the establishment in the EU.

The duration of infectious period is linked to the duration of viraemia previously reported in section.

3.1.1.8. Scarce data are available about carrier status (see Section 3.1.1.5)

The main point to control the entry of these infections to the EU is the control of imported animals. Recommendations for the importation of equines are that veterinary authorities of importing countries should require an international veterinary certificate attesting that the animals: showed no clinical sign of equine encephalomyelitis on the day of shipment and during the 3 months prior to shipment; animals were kept for the three months prior to shipment in an establishment where no case of equine encephalomyelitis was officially reported during that period; or animals were kept in a quarantine station for the 21 days prior to shipment and were protected from insect vectors during quarantine and transportation to the place of shipment; or animals were vaccinated not less than 15 days and not more than one year prior to shipment (OIE, 2016a). Alternatively, at entering EU, equids from third countries where these diseases are distributed, should present a 'Health Certificate' where vaccination status or results from haemagglutination inhibition tests to western and eastern equine encephalomyelitis performed on two occasions are shown.¹

3.1.1.9. Article 7(a)(viii) The existence of diagnostic and disease control tools

Diagnostic tools

Parameter 1 – Existence of diagnostic tools

As for other arboviruses, the period of viraemia is short and the titre is low so polymerase chain reaction (PCR) and/or viral isolation could be useful only if the sample was taken in acute phases of the disease and the cold chain is well preserved. Isolates may sometimes be obtained from cerebrospinal fluid (CSF) or from brain tissue (either at necropsy or post-mortem needle biopsy). Direct detection (and identification) of the virus confirms its presence. EEEV can usually be isolated from the brain of horses during the first 5 days of illness. WEEV is rarely isolated from tissues of infected horses. The most commonly used cell cultures are primary chicken or duck embryo fibroblasts, continuous cell lines of African green monkey kidney (Vero), rabbit kidney (RK-13), or baby hamster kidney (BHK-21) and the newborn mouse and the chicken embryo systems are also useful. Identification of the virus can be carried out by complement fixation, direct immunofluorescent staining, antigen-capture enzyme-linked immunosorbent assay (ELISA), immunohistochemical procedures or using the neutralisation test. Reverse-transcription polymerase chain reaction (RT-PCR) methods to detect EEE, WEE and VEE viral nucleic acid in mosquitoes and vertebrate tissues have been described, although few have been extensively validated for mammalian samples. These tools can also be used for direct identification using clinical samples but with a lesser sensitivity (OIE, 2013; CFSPH, 2015).

Detection of immunoglobulin M (IgM) in CSF samples could be also confirmatory although infection by other alphaviruses should be ruled out by epidemiological criteria and/or laboratory discrimination of the presence of antigenically related alphaviruses. Neutralisation of viral growth based-techniques are needed to do that. If no CSF is available and only serum samples are available, two samples taken 14 days apart are required to see a fourfold rise in the antibodies titre against each virus. Most horses infected with EEEV or WEEV have a high antibody titre when clinical disease is observed so, a presumptive diagnosis can be made if an unvaccinated horse with appropriate clinical signs has antibody against only EEEV or WEEV. The detection of IgM antibody by ELISA can also provide a presumptive diagnosis of acute infection. The haemagglutination inhibition test, complement fixation (CF) and other techniques can be used. CF antibody against both EEEV and WEEV appears later and does not persist; consequently, it is less useful for the serological diagnosis of disease. Previous vaccination can also interfere with interpretation of results so a good clinical history and two paired sera samples and/or CSF for IgM or direct detection are needed (OIE, 2013; CFSPH, 2015).

¹ Commission Decision 93/197/EEC of 5 February 1993 on animal health conditions and veterinary certification for imports of registered *equidae* and *equidae* for breeding and production. OJ L 86, 6.4.1993, p. 16-33.

So, methods suitable for EEEV and/or WEEV diagnosis are

- a) Direct detection
 - a. viral isolation
 - b. RT-PCR
 - c. CF
 - d. direct immunofluorescent staining
 - e. antigen-capture ELISA
 - f. immunohistochemical procedures
 - g. neutralisation test.
- b) Antibody detection
 - a. detection of IgM in CSF samples or in serum
 - b. haemagglutination inhibition tests
 - c. CF.

Control tools

Parameter 2 – Existence of control tools

Methods for preventing transmission:

Activities for control of these infections are individual prevention of mosquito bites by using protective clothing and repellents, control of vectors and vaccination of equines and some avian species. Surveillance using birds is also recommended.

Vaccination:

Regarding equine vaccination (in some cases EEEV vaccine is used in some birds), there is no effect of the vaccination in human health since equids are not good amplifiers for the virus.

EEE/WEE vaccines currently available are formalin-inactivated adjuvanted whole virus products and are distributed in different combinations as vaccines against EEEV and WEEV or adding also VEE and other agents for use in horses. These formalin-inactivated preparations were shown to be highly efficacious in protecting against clinical disease but the EEE vaccine preparation is made with a North American strain and it seems that they do not protect against South American strains (Dietz et al., 1980; Strizki and Repik, 1995). Other approaches to obtain second generation vaccines exists (Minke et al., 2004; Arechiga-Ceballos and Aguilar-Setien, 2015).

The availability of licensed vaccine products combined with an inability to completely eliminate risk of exposure justifies immunisation against EEE and WEE as core prophylaxis for all horses residing in or travelling to North America and any other geographic areas where EEE and/or WEE is endemic (Acha and Szyfres, 2003; AAEP, online).

3.1.2. Article 7(b) The impact of diseases

3.1.2.1. Article 7(b)(i) The impact of the disease on agricultural and aquaculture production and other parts of the economy

The viruses are circulating only in the Western hemisphere. No presence in EU.

Outbreaks of EEEV can cause important loss in the equine industry as demonstrated by epidemics in 1938 in USA when the virus affected 185,000 horses or in Louisiana in 1947, where 14,334 horses were affected and the mortality rate was 83% (Hubalek et al., 2014). From 1956 to 1970, EEEV was identified in USA in 605 encephalitic horses out of 2620 analysed (Acha and Szyfres, 2003). WEEV, in a minor extension, can also cause disease in horses and 6000 equine cases were recorded in California (1930) with a mortality of 50%, and epidemics occurred in Canada in 1937 and 1938 with a mortality of 28% affecting 12,000 and 52,000 horses respectively (Hubalek et al., 2014). Also in the USA, 174,000 horses in 1937 and 184,000 in 1938 were affected by WEEV or EEEV and between 1956 and 1970, WEEV was isolated in 2015 encephalitic horses out of 2,620 analysed (Acha and Szyfres, 2003).

The economic impact for horses is not well established. As an example for other viruses such as West Nile Virus in USA, an epidemic caused 569 cases in horses with 22% mortality in North Dakota. Losses resulted in costs of US\$ 1.5 million spent in medical services and due to inability to use horses for recreation purposes because of the disease (Ndiva Mongoh et al., 2008).

3.1.2.2. Article 7(b)(ii) The impact of the disease on human health

Humans get infected by the bite of an infected mosquito. No other route of transmission has been demonstrated. Infections could occur as sporadic cases, small outbreaks or epidemics if not controlled. Most human infections by EEEV are asymptomatic, but when CNS involvement occurs, it results in frequent and severe neurological signs, lesions, and sequelae. The mortality rate associated to human cases of EEE varies from 50% to 75% and the young are at greater risk of clinical disease. The early clinical illness involves a flu-like prodromal stage of about 5 days dominated by high fever and headache and death can occur within 3–5 days of infection (Calisher, 1994). Children commonly exhibit facial oedema. Paresis, paralysis, respiratory impairment, altered mental state and seizures are common neurological manifestations and many of these signs persist for long periods in patients who survive the acute illness. Survivors suffer from neurological sequelae, including convulsions, paralysis, and mental retardation.

WEEV causes asymptomatic or mild infections in humans, with non-specific symptoms such as sudden onset of fever, headache, nausea, vomiting, anorexia and malaise. Some patients may also present with altered mental status and weakness, with signs of meningeal irritation. The infection may cause encephalitis or encephalomyelitis, resulting in neck stiffness, confusion, visual disturbances, photophobia, tonic-clonic seizures, somnolence, coma, and death in rare cases. An estimated 90% of humans with WEE under the age of 1 year show severe CNS signs (Calisher, 1994). Estimates of the case fatality rate of WEE range from 3% to 15%. Fifteen to fifty per cent of the encephalitis survivors, especially young children, suffer from permanent neurological damage (mental retardation, emotional instability and spastic paresis). The mortality rate of a few cases of aerosolised WEE in humans, as those occurred in laboratory workers, was 40% (Hanson et al., 1967). WEEV has mortality range of 3–7%.

Neurological sequelae (confusion, visual disturbances, photophobia, seizures, somnolence, coma, intellectual disability, and emotional instability/behavioural changes and spastic paresis) in 15–30% of WEE survivors have been described. In the case of EEE survivors, convulsions, seizures, paralysis, intellectual disability and behavioural changes have been observed in 50–90% of the survivors (Ronca et al., 2016).

No data about disability-adjusted life year (DALY) are available. There is no specific treatment against these viruses and vaccines for humans are also recommended for laboratory workers or military personnel.

3.1.2.3. Article 7(b)(iii) The impact of the disease on animal welfare

The impact on animal welfare is not well established although during EEE outbreaks, many avian species could develop illness with fever, ataxia, trembling, leg and generalised paralysis and death (Scott and Weaver, 1989; Acha and Szyfres, 2003; Hubalek et al., 2014; CFSPH, 2015). For infected horses, 80–90% develop acute and lethal disease, and about 66% of the survivors develop neurological sequelae (Scott and Weaver, 1989) while for WEEV mortality is about 20–30% (Acha and Szyfres, 2003; CFSPH, 2015).

3.1.2.4. Article 7(b)(iv) The impact of the disease on biodiversity and the environment

Many wild rodents, amphibians, reptiles and other animals could be infected by these viruses but the viruses affect mainly equine and avian (mainly passerine birds) species. No data about the susceptibility of European species are available. The mortality in due to infection with EEEV or WEEV of wild animal species has not been calculated.

The non-controlled use of non-approved repellents for vector control could have some effect on the environment but strict regulations should be applied. To assess the potential impact on the environment of chemical biocidal products used to control potential outbreaks of vector-borne diseases, information was extracted from ECHA's website on approved active substances which may be used for controlling the relevant vector species (EFSA AHAW Panel, 2017b). Any potential impact on the environment of the use of biocidal products beyond the intended uses, doses and target species as evaluated by European Chemicals Agency (ECHA) is unknown.

Persistence of EEEV or WEEV in the environment outside their hosts or vectors is not of concern.

3.1.3. Article 7(c) Its potential to generate a crisis situation and its potential use in bioterrorism

EEEV and WEEV are included in the List of Human and Animal Pathogens and Toxins for Export Control by the Australia group (AG, online). They are classified in the category B [viral encephalitis

alphaviruses (e.g. VEE, EEE, WEE)] of CDC Bioterrorism Agents (CDC, online-b). EEEV, except the South American genotype, is a select agent that requires registration with CDC and/or USDA for possession, use, storage and/or transfer since it has the potential to pose a severe threat to public health and safety, to animal and plant health, or to animal or plant products (CDC, online-a). Both viruses are listed in the OIE list of notifiable terrestrial and aquatic animal diseases (OIE, online).

3.1.4. Article 7(d) The feasibility, availability and effectiveness of the following disease prevention and control measures

3.1.4.1. Article 7(d)(i) Diagnostic tools and capacities

On July 2011, only six countries (France, Germany, Italy, the Netherlands, Slovakia and Spain), belonging to the European Network for the Diagnostic of Imported Viral Diseases (ENIVD), had laboratories where specific detection of EEEV and/or WEEV could be carried out (ENIVD, online).

Methods available are in-house tests whose sensitivity and specificity need to be established.

There are no commercial, internationally recognised and/or OIE certified specific tools for diagnostic of these viruses.

For human infections, diagnostic is carried out in CSF and/or serum samples. In the case of animal infection, other tissues could be used including brain.

3.1.4.2. Article 7(d)(ii) Vaccination

Commercial vaccines based on inactivated virus are available for horse vaccination.

Testing of EEEV/WEEV vaccines was performed by intracranial challenge with either EEEV or WEEV; the formalin-inactivated preparations were shown to be highly efficacious in protecting against clinical disease. Since vaccines do not confer long-lasting protection, vaccination against EEEV in the USA is recommended once a year and in areas at high risk, more often (AAEP, online). Since EEEV vaccines are against North American strains, they are not so effective against MADV (Dietz et al., 1980; Strizki and Repik, 1995). Horses should be vaccinated twice a year against WEEV due to low immunogenicity (Barber et al., 1978). Vaccines are administered by injecting 1 mL doses intramuscularly using aseptic techniques. After the first dose, a second one is recommended after 3–4 weeks. Later, yearly vaccination (or more often in case of high risk) is recommended (Arechiga-Ceballos and Aguilar-Setien, 2015).

No vaccine for human use is available. Only vaccines to be used in horses are commercially distributed but no vaccines have been authorised for use in the European Union by the European Medicine Agency (EMA)²

3.1.4.3. Article 7(d)(iii) Medical treatments

No medical treatment is available for these infections.

3.1.4.4. Article 7(d)(iv) Biosecurity measures

Severe clinical disease or death can occur in humans and four laboratory-acquired cases of EEE and seven cases of WEE (with two deaths) have been reported and the recommendation is that to work with these viruses in a biosafety level 3 (BSL3) facility although a lesser biosafety level could be used with diagnostic samples. If viral isolation is tried a BSL3 facility is needed (Anonymous, 1980). Laboratories with suitable BSL facilities are available throughout Europe. However, access to diagnostic tests is limited.

Due to the route of transmission (infected mosquitoes) of these viruses, biosecurity measures are not a requirement in preventing the pathogen introduction in EU.

3.1.4.5. Article 7(d)(v) Restrictions on the movement of animals and products

No specific recommendation for restrictions of movements for EEEV and/or WEEV infected animals is available. If a case is detected within EU, measures for vector control should be applied trying to reduce vector numbers in an area by treatment and/or elimination of potential breeding sites. Large-scale insecticide spraying is generally too costly, ineffective in the long-term, and/or environmentally unacceptable. Other approaches might be to treat susceptible animals with long acting insecticides during critical periods or remove animals from high-activity insect vector areas either continuously or during times of the day or year when insect vectors are most active. If necessary, zoning and compartmentalisation measures could be applied (OIE, 2016b).

² <http://www.ema.europa.eu/ema/>

3.1.4.6. Article 7(d)(vi) Killing of animals

Methods for killing of animals, if necessary, are compiled in (OIE, 2016c), no specific recommendation for EEEV and/or WEEV infected animals are available.

3.1.4.7. Article 7(d)(vii) Disposal of carcasses and other relevant animal by-products

Animal carcasses and products derived from EEEV and/or WEEV infected animals pose a negligible transmission risk so no special measures are warranted (Williams, 2003).

3.1.5. Article 7(e) The impact of disease prevention and control measures

3.1.5.1. Article 7(e)(i) The direct and indirect costs for the affected sectors and the economy as a whole

After the Texas WEE outbreak in 1971, the cost of infection per person was estimated as \$320,000 (Earnest et al., 1971). The economic burden associated with patients suffering long-term sequelae due to EEE was also determined. Hospital costs for the first week of infection were approximately \$21,000 but medical costs for someone suffering from long-term sequelae, would exceed \$0.4 million per year per individual, with costs reaching up to \$3 million in the life span of the affected individual. The cost of insecticidal prevention of mosquito vectors was estimated as \$0.7–1.4 million dollars (Villari et al., 1995).

As a general rule, a horse owner might save about 2 per cent of the annual cost by not inoculating the horse with the core vaccines that includes WEEV and EEEV; however, the cost of not vaccinating can far outweigh the potential savings (Scott, 2015).

Although no precise data are available for WEEV or EEEV, cost estimations for West Nile virus affecting horses in Texas have been calculated by Galvan and colleagues (Galvan et al., online) and they estimate the cost of vaccination as US\$6,250,000 in 2002 and US\$6,250,000 in 2003 while costs of mortality of infected horses during 2002 was US\$2,856,000 and during 2003 it was US\$1,205,400.

3.1.5.2. Article 7(e)(ii) The societal acceptance of disease prevention and control measures

No references have been found regarding this item.

3.1.5.3. Article 7(e)(iii) The welfare of affected subpopulations of kept and wild animals

One of the measures for control is avoiding mosquito bites and this could imply stabling of animals so regulations should be followed.

Uncontrolled use of insecticides could affect some animal species but strict regulations should be applied in case of need of using these compounds.

3.1.5.4. Article 7(e)(iv) The environment and biodiversity

Uncontrolled use of insecticides could affect environment and biodiversity but strict regulations should be applied in case of need of using these compounds but no mortality in wild species because of the control measures to be applied is expected.

3.2. Assessment according to Article 5 criteria

This section presents the results of the expert judgement on the criteria of Article 5 of the AHL about equine encephalomyelitis (Eastern and Western) (Table 4). The expert judgement was based on Individual and Collective Behavioural Aggregation (ICBA) approach described in detail in the opinion on the methodology (EFSA AHAW Panel, 2017a). Experts have been provided with information of the disease fact-sheet mapped into Article 5 criteria (see supporting information, Annex A), based on that the experts indicate their Y/N or 'na' judgement on each criterion of Article 5, and the reasoning supporting their judgement.

The minimum number of judges in the judgement was 12. The expert judgement was conducted as described in the methodological opinion (EFSA AHAW Panel, 2017a). For details on the interpretation of the questions see Appendix B of the methodological opinion (EFSA AHAW Panel, 2017a).

Table 4: Outcome of the expert judgement on the Article 5 criteria for equine encephalomyelitis (Eastern and Western)

Criteria to be met by the disease: According to AHL, a disease shall be included in the list referred to in point (b) of paragraph 1 of Article 5 if it has been assessed in accordance with Article 7 and meets all of the following criteria		Final outcome
A(i)	The disease is transmissible	Y
A(ii)	Animal species are either susceptible to the disease or vectors and reservoirs thereof exist in the Union	Y
A(iii)	The disease causes negative effects on animal health or poses a risk to public health due to its zoonotic character	Y
A(iv)	Diagnostic tools are available for the disease	Y
A(v)	Risk-mitigating measures and, where relevant, surveillance of the disease are effective and proportionate to the risks posed by the disease in the Union	Y
At least one criterion to be met by the disease: In addition to the criteria set out above at points A(i)–A(v), the disease needs to fulfil at least one of the following criteria		
B(i)	The disease causes or could cause significant negative effects in the Union on animal health, or poses or could pose a significant risk to public health due to its zoonotic character	Y
B(ii)	The disease agent has developed resistance to treatments and poses a significant danger to public and/or animal health in the Union	na
B(iii)	The disease causes or could cause a significant negative economic impact affecting agriculture or aquaculture production in the Union	NC
B(iv)	The disease has the potential to generate a crisis or the disease agent could be used for the purpose of bioterrorism	Y
B(v)	The disease has or could have a significant negative impact on the environment, including biodiversity, of the Union	NC

Colour code: green = consensus (Yes/No); yellow = no consensus (NC); red = not applicable (na), i.e. insufficient evidence or not relevant to judge.

3.2.1. Non-consensus questions

This section displays the assessment related to each criterion of Article 5 where no consensus was achieved in form of tables (Tables 5 and 6). The proportion of Y, N or na answers are reported, followed by the list of different supporting views for each answer.

Table 5: Outcome of the expert judgement related to criterion 5 B(iii)

Question	Final outcome	Response		
		Y (%)	N (%)	na (%)
B(iii) The disease causes or could cause a significant negative economic impact affecting agriculture or aquaculture production in the Union	NC	83	17	0

NC: non-consensus; number of judges: 12.

Reasoning supporting the judgement

Supporting Yes:

- Considering the horse sector, if introduced, EEE and WEE may have a high impact due to their epidemic potential and high mortality in horses.
- For the sector of race horses, even a low number of affected animals may result in very high losses in terms of costs.
- Depending on the area where the disease is introduced, there could be a significant impact (i.e. foal markets). Even if one single infected animal is introduced, markets could be closed (France as example).
- There may be a potential significant economic impact considering production of race horses in the absence of control measures (vector control or vaccination).

Supporting No:

- The opinion on vector-borne diseases (EFSA AHAW Panel, 2017b) indicates that the probability of spread in the Union is low due to too low densities of vectors and hosts. Thus, the potential impact can be considered to be low.

Table 6: Outcome of the expert judgement related to criterion 5 B(v)

Question	Final outcome	Response		
		Y (%)	N (%)	na (%)
B(v) Disease has or could have a significant negative impact on the environment, including biodiversity, of the Union	NC	0	58	42

NC: non-consensus; number of judges: 12.

Reasoning supporting the judgement

Supporting No:

- The model in the scientific opinion on vector-borne diseases (EFSA AHAW Panel, 2017b) suggests that the impact of these diseases on the environment and biodiversity is likely to be low.

Supporting na:

- Cases in the US are well-known and there is no significant impact, but it is difficult to infer how the disease would behave in completely different ecosystems in the EU.
- There is a lack of information concerning the susceptibility of the European bird population.

3.2.2. Outcome of the assessment of equine encephalomyelitis (Eastern and Western) according to criteria of Article 5(3) of the AHL on its eligibility to be listed

As from the legal text of the AHL, a disease is considered eligible to be listed as laid down in Article 5 if it fulfils all criteria of the first set from A(i) to A(v) and at least one of the second set of criteria from B(i) to B(v). According to the assessment methodology (EFSA AHAW Panel, 2017a), a criterion is considered fulfilled when the outcome is 'Yes'. According to the results shown in Table 4, equine encephalomyelitis (Eastern and Western) complies with all criteria of the first set and with two criteria of the second set, therefore it is considered eligible to be listed as laid down in Article 5 of the AHL.

3.3. Assessment according to Article 9 criteria

This section presents the results of the expert judgement on the criteria of Annex IV referring to categories as in Article 9 of the AHL about equine encephalomyelitis (Eastern and Western) (Tables 7–11). The expert judgement was based on ICBA approach described in detail in the opinion on the methodology. Experts have been provided with information of the disease fact-sheet mapped into Article 9 criteria (see supporting information, Annex A), based on that the experts indicate their Y/N or 'na' judgement on each criterion of Article 9, and the reasoning supporting their judgement.

The minimum number of judges in the judgement was 12. The expert judgement was conducted as described in the methodological opinion (EFSA AHAW Panel, 2017a). For details on the interpretation of the questions, see Appendix B of the methodological opinion (EFSA AHAW Panel, 2017a).

Table 7: Outcome of the expert judgement related to the criteria of Section 1 of Annex IV (category A of Article 9) for equine encephalomyelitis (Eastern and Western)

Criteria to be met by the disease: The disease needs to fulfil all of the following criteria		Final outcome
1	The disease is not present in the territory of the Union OR present only in exceptional cases (irregular introductions) OR present in only in a very limited part of the territory of the Union	Y
2.1	The disease is highly transmissible	N
2.2	There be possibilities of airborne or waterborne or vector-borne spread	Y

2.3	The disease affects multiple species of kept and wild animals OR single species of kept animals of economic importance	Y
2.4	The disease may result in high morbidity and significant mortality rates	Y
At least one criterion to be met by the disease:		
In addition to the criteria set out above at points 1–2.4, the disease needs to fulfil at least one of the following criteria		
3	The disease has a zoonotic potential with significant consequences on public health, including epidemic or pandemic potential OR possible significant threats to food safety	N
4	The disease has a significant impact on the economy of the Union, causing substantial costs, mainly related to its direct impact on the health and productivity of animals	N
5(a)	The disease has a significant impact on society, with in particular an impact on labour markets	N
5(b)	The disease has a significant impact on animal welfare, by causing suffering of large numbers of animals	NC
5(c)	The disease has a significant impact on the environment, due to the direct impact of the disease OR due to the measures taken to control it	na
5(d)	The disease has a significant impact on a long-term effect on biodiversity or the protection of endangered species or breeds, including the possible disappearance or long-term damage to those species or breeds	NC

Colour code: green = consensus (Yes/No); yellow = no consensus (NC); red = not applicable (na), i.e. insufficient evidence or not relevant to judge.

Table 8: Outcome of the expert judgement related to the criteria of Section 2 of Annex IV (category B of Article 9) for equine encephalomyelitis (Eastern and Western)

Criteria to be met by the disease:		Final outcome
The disease needs to fulfil all of the following criteria		
1	The disease is present in the whole OR part of the Union territory with an endemic character AND (at the same time) several Member States or zones of the Union are free of the disease	N
2.1	The disease is moderately to highly transmissible	Y
2.2	There be possibilities of airborne or waterborne or vector-borne spread	Y
2.3	The disease affects single or multiple species	Y
2.4	The disease may result in high morbidity with in general low mortality	N
At least one criterion to be met by the disease:		
In addition to the criteria set out above at points 1–2.4, the disease needs to fulfil at least one of the following criteria		
3	The disease has a zoonotic potential with significant consequences on public health, including epidemic potential OR possible significant threats to food safety	N
4	The disease has a significant impact on the economy of the Union, causing substantial costs, mainly related to its direct impact on the health and productivity of animals	N
5(a)	The disease has a significant impact on society, with in particular an impact on labour markets	N
5(b)	The disease has a significant impact on animal welfare, by causing suffering of large numbers of animals	NC
5(c)	The disease has a significant impact on the environment, due to the direct impact of the disease OR due to the measures taken to control it	na
5(d)	The disease has a significant impact on a long-term effect on biodiversity or the protection of endangered species or breeds, including the possible disappearance or long-term damage to those species or breeds	NC

Colour code: green = consensus (Yes/No); yellow = no consensus (NC); red = not applicable (na), i.e. insufficient evidence or not relevant to judge.

Table 9: Outcome of the expert judgement related to the criteria of Section 3 of Annex IV (category C of Article 9) for equine encephalomyelitis (Eastern and Western)

Criteria to be met by the disease: The disease needs to fulfil all of the following criteria		Final outcome
1	The disease is present in the whole OR part of the Union territory with an endemic character	N
2.1	The disease is moderately to highly transmissible	Y
2.2	The disease is transmitted mainly by direct or indirect transmission	Y
2.3	The disease affects single or multiple species	Y
2.4	The disease usually does not result in high morbidity and has negligible or no mortality AND often the most observed effect of the disease is production loss	N
At least one criterion to be met by the disease: In addition to the criteria set out above at points 1–2.4, the disease needs to fulfil at least one of the following criteria		
3	The disease has a zoonotic potential with significant consequences on public health, or possible significant threats to food safety	Y
4	The disease has a significant impact on the economy of parts of the Union, mainly related to its direct impact on certain types of animal production systems	Y
5(a)	The disease has a significant impact on society, with in particular an impact on labour markets	N
5(b)	The disease has a significant impact on animal welfare, by causing suffering of large numbers of animals	NC
5(c)	The disease has a significant impact on the environment, due to the direct impact of the disease OR due to the measures taken to control it	na
5(d)	The disease has a significant impact on a long-term effect on biodiversity or the protection of endangered species or breeds, including the possible disappearance or long-term damage to those species or breeds	NC

Colour code: green = consensus (Yes/No); yellow = no consensus (NC); red = not applicable (na), i.e. insufficient evidence or not relevant to judge.

Table 10: Outcome of the expert judgement related to the criteria of Section 4 of Annex IV (category D of Article 9) for equine encephalomyelitis (Eastern and Western)

Criteria to be met by the disease: The disease needs to fulfil all of the following criteria		Final outcome
D	The risk posed by the disease in question can be effectively and proportionately mitigated by measures concerning movements of animals and products in order to prevent or limit its occurrence and spread	NC
The disease fulfils criteria of Sections 1, 2, 3 or 5 of Annex IV of AHL		Y

Colour code: green = consensus (Yes/No); yellow = no consensus (NC).

Table 11: Outcome of the expert judgement related to the criteria of Section 5 of Annex IV (category E of Article 9) for equine encephalomyelitis (Eastern and Western)

Diseases in category E need to fulfil criteria of Sections 1, 2 or 3 of Annex IV of AHL and/or the following:		Final outcome
E	Surveillance of the disease is necessary for reasons relating to animal health, animal welfare, human health, the economy, society or the environment (If a disease fulfils the criteria as in Article 5, thus being eligible to be listed, consequently category E would apply.)	Y

Colour code: green = consensus (Yes/No).

3.3.1. Non-consensus questions

This section displays the assessment related to each criterion of Annex IV referring to the categories of Article 9 of the AHL where no consensus was achieved in form of tables (Tables 12–14). The proportion of Y, N or 'na' answers are reported, followed by the list of different supporting views for each answer.

Table 12: Outcome of the expert judgement related to criterion 5(b) of Article 9

Question	Final outcome	Response		
		Y (%)	N (%)	na (%)
5(b) The disease has a significant impact on animal welfare, by causing suffering of large numbers of animals	NC	50	33	17

NC: non-consensus; number of judges: 12.

Reasoning supporting the judgement

Supporting Yes:

- If introduced in the EU and in the absence of control measures, the animal welfare impact would be significant.
- High morbidity with severe clinical signs (neurological sequelae) has been described.
- There is potential for significant animal welfare impact. Outbreaks of EEE in horses in North America have been common and often accompanied by high case fatality rates: 80–90% of the infected horses developed acute and lethal disease, and about 66% of the survivors developed neurological sequelae (Scott and Weaver, 1989). The mortality is lower for WEEV, which generally causes a mild disease but in some cases, symptoms of altered mental status, weakness and signs of meningeal irritation occur and a minority of infected individuals develop encephalitis or encephalomyelitis.

Supporting No:

- The animal welfare impact is not considered to affect large numbers of animals.
- Based on the model as in the scientific opinion on vector-borne diseases (EFSA AHAW Panel, 2017b), the likelihood of animal welfare impact for large numbers in the EU is low.

Supporting na:

- There may be an impact on animal welfare for the affected horses but it is difficult to state that this would be on 'large numbers'.
- In the USA, there have been large epizootics, but the model in the scientific opinion on vector-borne diseases (EFSA AHAW Panel, 2017b) showed that for EEEV there was a very low to low rate of introduction, and subsequently, a very low extent of annual spread. The latter had high uncertainty due to the high uncertainty related to the efficacy of the control measures to contain the spread. The annual extent of spread of WEEV has not been assessed, as the overall rate of introduction was estimated to be very low (EFSA AHAW Panel, 2017b).

Table 13: Outcome of the expert judgement related to criterion 5(d) of Article 9

Question	Final outcome	Response		
		Y (%)	N (%)	na (%)
5(d) The disease has a significant impact on a long-term effect on biodiversity or the protection of endangered species or breeds, including the possible disappearance or long-term damage to those species or breeds	NC	0	25	75

NC: non-consensus; number of judges: 12.

Reasoning supporting the judgement

Supporting No:

- In the scientific opinion on vector-borne diseases (EFSA AHAW Panel, 2017b), the disease spread and impact was not assessed for WEE due to very low rate of introduction and only low extent of spread was assessed for EEE. According to that, there is no significant impact on biodiversity.

Supporting na:

- There is evidence available in the US, but it is difficult to determine how the disease would behave in a different ecosystem in the EU.
- No information is available on susceptibility of wild species (e.g. birds or rodents) in the EU.
- It is uncertain whether there would be an impact with a long-term effect on biodiversity.

Table 14: Outcome of the expert judgement related to criterion D of Article 9

Question	Final outcome	Response		
		Y (%)	N (%)	na (%)
D The risk posed by the disease in question can be effectively and proportionately mitigated by measures concerning movements of animals and products in order to prevent or limit its occurrence and spread	NC	33	67	0

NC: non-consensus; number of judges: 12.

Reasoning supporting the judgement

Supporting Yes:

- Movement restrictions and regulations on import of reservoir animals (i.e. birds, reptiles, rodents and amphibian) into the EU can reduce the introduction and spread of these infections, although may not be totally effective in preventing it.

Supporting No:

- Controls in imported animals may not be sufficiently effective in totally preventing disease introduction and trade of ornamental birds could pose a serious risk, because the quarantine or testing of these species is not feasible. Movement control measures would not prevent spread of the disease by mosquitoes and wild birds.

3.3.2. Outcome of the assessment of criteria in Annex IV for equine encephalomyelitis (Eastern and Western) disease for the purpose of categorisation as in Article 9 of the AHL

As from the legal text of the AHL, a disease is considered fitting in a certain category (A, B, C, D or E corresponding to point (a) to point (e) of Article 9(1) of the AHL) if it is eligible to be listed for Union intervention as laid down in Article 5(3) and fulfils all criteria of the first set from 1 to 2.4 and at least one of the second set of criteria from 3 to 5(d) as shown in Tables 7–11. According to the assessment methodology (EFSA AHAW Panel, 2017a), a criterion is considered fulfilled when the outcome is 'Yes'.

A description of the outcome of the assessment of criteria in Annex IV for equine encephalomyelitis (Eastern and Western) for the purpose of categorisation as in Article 9 of the AHL is presented in Table 15.

Table 15: Outcome of the assessment of criteria in Annex IV for equine encephalomyelitis (Eastern and Western) for the purpose of categorisation as in Article 9 of the AHL

Category	Article 9 criteria										
	1° set of criteria					2° set of criteria					
	1	2.1	2.2	2.3	2.4	3	4	5a	5b	5c	5d
	Geographical distribution	Transmissibility	Routes of transmission	Multiple species	Morbidity and mortality	Zoonotic potential	Impact on economy	Impact on society	Impact on animal welfare	Impact on environment	Impact on biodiversity
A	Y	N	Y	Y	Y	N	N	N	NC	na	NC
B	N	Y	Y	Y	N	N	N	N	NC	na	NC
C	N	Y	Y	Y	N	Y	Y	N	NC	na	NC
D	NC										
E	Y										

According to the assessment here performed, equine encephalomyelitis (Eastern and Western) complies with the following criteria of the Sections 1–5 of Annex IV of the AHL for the application of the disease prevention and control rules referred to in points (a) to (e) of Article 9(1):

- 1) To be assigned to category A, a disease needs to comply with all criteria of the first set (1, 2.1–2.4) and according to the assessment equine encephalomyelitis (Eastern and Western) complies with criteria 1, 2.2, 2.3 and 2.4, but not with 2.1. To be eligible for category A, a disease needs to comply additionally with one of the criteria of the second set (3, 4, 5a–d) and equine encephalomyelitis (Eastern and Western) does not comply with criteria 3, 4 and 5a, the assessment is inconclusive on compliance with criteria 5b and 5d and not applicable on criterion 5c.
- 2) To be assigned to category B, a disease needs to comply with all criteria of the first set (1, 2.1–2.4) and according to the assessment equine encephalomyelitis (Eastern and Western) complies with criteria 2.1, 2.2 and 2.3, but not with criteria 1 and 2.4. To be eligible for category B, a disease needs to comply additionally with one of the criteria of the second set (3, 4, 5a–d) and equine encephalomyelitis (Eastern and Western) does not comply with criteria 3, 4 and 5a, the assessment is inconclusive on compliance with criteria 5b and 5d and not applicable on criterion 5c.
- 3) To be assigned to category C, a disease needs to comply with all criteria of the first set (1, 2.1–2.4) and according to the assessment equine encephalomyelitis (Eastern and Western) complies with criteria 2.1, 2.2 and 2.3, but not with criteria 1 and 2.4. To be eligible for category C, a disease needs to comply additionally with one of the criteria of the second set (3, 4, 5a–d) and equine encephalomyelitis (Eastern and Western) complies with criteria 3 and 4, but not with criterion 5a, the assessment is inconclusive on compliance with criteria 5b and 5d and not applicable on criterion 5c.
- 4) To be assigned to category D, a disease needs to comply with criteria of Sections 1, 2, 3 or 5 of Annex IV of the AHL, with which equine encephalomyelitis (Eastern and Western) complies, and with the specific criterion D of Section 4, with which the assessment on equine encephalomyelitis (Eastern and Western) is inconclusive.
- 5) To be assigned to category E, a disease needs to comply with criteria of Sections 1, 2 or 3 of Annex IV of the AHL and/or the surveillance of the disease is necessary for reasons relating to animal health, animal welfare, human health, the economy, society or the environment. The latter is applicable if a disease fulfils the criteria as in Article 5, with which equine encephalomyelitis (Eastern and Western) complies.

3.4. Assessment of Article 8

This section presents the results of the assessment on the criteria of Article 8(3) of the AHL about equine encephalomyelitis (Eastern and Western). The Article 8(3) criteria are about animal species to be listed, as it reads below:

'3. Animal species or groups of animal species shall be added to this list if they are affected or if they pose a risk for the spread of a specific listed disease because:

- a) they are susceptible for a specific listed disease or scientific evidence indicates that such susceptibility is likely; or
- b) they are vector species or reservoirs for that disease, or scientific evidence indicates that such role is likely'.

For this reason, the assessment on Article 8 criteria is based on the evidence as extrapolated from the relevant criteria of Article 7, i.e. the ones related to susceptible and reservoir species or routes of transmission, which cover also possible role of biological or mechanical vectors.³ According to the mapping, as presented in Table 5, Section 3.2 of the scientific opinion on the ad hoc methodology (EFSA AHAW Panel, 2017a), the main animal species to be listed for equine encephalomyelitis (Eastern

Table 16: Main animal species to be listed for Eastern equine encephalomyelitis according to criteria of Article 8 (source: data reported in Sections 3.1.1.1 and 3.1.1.6)

	Class	Order	Family	Genus/Species
Susceptible	Mammalia	Artiodactyla	Cervidae	<i>Odocoileus virginianus</i>
			Suidae	<i>Sus scrofa</i>
			Bovidae	<i>Bos taurus</i> , <i>Ovis aries</i>
		Perissodactyla	Equidae	<i>Equus caballus</i> , <i>Equus asinus</i>
		Carnivora	Canidae	<i>Canis lupus</i>
		Rodentia	Muridae	<i>Mus mus</i>
	Aves	Sphenisciformes	Spheniscidae	<i>Spheniscus demersus</i>
		Passeriformes	Passeridae	not specified
			Corvidae	not specified
		Casuariiformes	Dromaiidae	<i>Dromaius</i> spp.
		Strigiformes	Strigidae	<i>Bubo virginianus</i>
		Galliformes	Phasianidae	<i>Phasianus</i> spp., <i>Meleagris</i> spp.
	Reptilia	Squamata	Polychrotidae	Carolina anole (<i>Anolis carolinensis</i>)
			Colubridae	Garter snake (<i>Thamnophis sirtalis</i>)
	Amphibia	Not specified		
Reservoir	Aves	Passeriformes		
	Mammalia	Rodentia	not specified	
		Marsupialia	not specified	
Vectors	Insecta	Diptera	Culicidae	<i>Culiseta melanura</i> , <i>Culex</i> (<i>Melanoconion</i>)

and Western) according to the criteria of Article 8(3) of the AHL are as displayed in Tables 16 and 17.

³ A vector is a living organism that transmits an infectious agent from an infected animal to a human or another animal. Vectors are frequently arthropods. Biological vectors may carry pathogens that can multiply within their bodies and be delivered to new hosts, usually by biting. In mechanical vectors the pathogens do not multiply within the vector, which usually remains infected for shorter time than in biological vectors.

Table 17: Main animal species to be listed for Western equine encephalomyelitis according to criteria of Article 8 (source: data reported in Sections 3.1.1.1 and 3.1.1.6)

	Class	Order	Family	Genus/Species
Susceptible	Mammalia	Perissodactyla	Equidae	<i>Equus caballus</i>
		Lagomorpha	Leporidae	<i>Lepus californicus californicus</i>
		Rodentia	Sciuridae	<i>Citellus richardsoni</i>
	Aves	Passeriformes		
	Reptilia	Snakes (not specified)		
	Amphibia	Frogs (not specified)		
Reservoir	Aves	different species of birds		
	Mammalia	Rodentia	Cricetidae	<i>Oryzomys</i> spp.
		Lagomorpha	Leporidae	<i>Oryctolagus</i> spp., <i>Lepus europeus</i>
Vectors	Insecta	Diptera	Culicidae	<i>Culex tarsalis</i> , <i>Aedes vexans</i> , <i>Aedes dorsalis</i>

4. Conclusions

TOR 1: for each of those diseases an assessment, following the criteria laid down in Article 7 of the AHL, on its eligibility of being listed for Union intervention as laid down in Article 5(3) of the AHL;

- According to the assessment here performed, equine encephalomyelitis (Eastern and Western) complies with all criteria of the first set and with two criteria of the second set and therefore can be considered eligible to be listed for Union intervention as laid down in Article 5(3) of the AHL.

TOR 2a: for each of the diseases which was found eligible to be listed for Union intervention, an assessment of its compliance with each of the criteria in Annex IV to the AHL for the purpose of categorisation of diseases in accordance with Article 9 of the AHL;

- According to the assessment here performed, equine encephalomyelitis (Eastern and Western) meets the criteria as in Section 5 of Annex IV of the AHL, for the application of the disease prevention and control rules referred to in point (e) of Article 9(1) of the AHL. According to the assessment here performed, it is inconclusive whether equine encephalomyelitis (Eastern and Western) complies with the criteria as in Section 4 of Annex IV of the AHL, for the application of the disease prevention and control rules referred to in point (d) of Article 9(1) of the AHL. Compliance of equine encephalomyelitis (Eastern and Western) with the criteria as in Section 4 is dependent on a decision on criterion D.

TOR 2b: for each of the diseases which was found eligible to be listed for Union intervention, a list of animal species that should be considered candidates for listing in accordance with Article 8 of the AHL.

- According to the assessment here performed, the animal species that can be considered to be listed for equine encephalomyelitis (Eastern and Western) according to Article 8(3) of the AHL are several species of mammals, birds, reptiles and amphibians as susceptible species; rodents, lagomorphs and several bird species as reservoirs and at least four mosquito species (family Culicidae) as vectors, as reported in Tables 16 and 17 in Section 3.4 of the present document.

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Abbreviations

AHAW	EFSA Panel on Animal Health and Welfare
AHL	Animal Health Law
BHK	baby hamster kidney

CDC	Centers for Disease Control and Prevention
CF	complement fixation
CSF	cerebrospinal fluid
DALY	disability-adjusted life year
ECHA	European Chemicals Agency
EEE	Eastern Equine Encephalitis
EEEV	Eastern Equine Encephalitis virus
ELISA	enzyme-linked immunosorbent assay
EMA	European Medicine Agency
ENIVD	European Network for the Diagnostic of Imported Viral Diseases
ICBA	Individual and Collective Behavioural Aggregation
IgM	immunoglobulin M
MADV	Madariaga virus
OIE	World Organization for Animal Health
PCR	polymerase chain reaction
RK	rabbit kidney
RT	reverse-transcription
ToR	Terms of Reference
VEE	Venezuelan equine encephalitis
WEE	Western Equine Encephalitis
WEEV	Western Equine Encephalitis virus